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CLEANING SHEET AND MANUFACTURING METHOD THEREOF

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Abstract**Objective**

To provide a type of cleaning sheet, that can reliably trap and remove fine dust as well as relatively large debris, as well as its manufacturing method.

Constitution

Cleaning sheet (10) in an application example of this invention is characterized by the following facts: base sheet (11) and base cloth (12) made of a nonwoven fabric integrated by means

of intertwining fibers, and mesh-like sheet (14) formed by intertwining fibers with interfiber distance greater than that of base cloth (12) and placed on the outer side of base cloth (12) are laminated; these layers are partially bonded to each other; bonded portions (13A) among base sheet (11), said base cloth (12) and mesh-like sheet (14) become depressions, while unbonded portions (13B), (15B) overall form projections.

//insert figure//

Claims

1. A cleaning sheet, characterized by the fact that a heat-shrinkable base sheet, a base cloth made of nonwoven fabric integrated by intertwining the fibers, and a meshing sheet of nonwoven fabric, whose interfiber distance is greater than said base sheet, formed by intertwining fibers, are stacked in order; the aforementioned base sheet, the aforementioned base cloth, and the aforementioned meshing sheet are partially bonded; said bonded portions are formed into depressions; and all of the unbonded portions are formed into projections.

2. The cleaning sheet described in Claim 1, characterized by the fact that a pair of base cloths are placed on the two sides of the aforementioned base sheet, and mesh-like sheets are placed on the outside of each of these base cloths.

3. The cleaning sheet described in Claim 1 or 2, characterized by the fact that holes are formed in the unbonded portions of the aforementioned base cloth.

4. A method of manufacturing cleaning sheets, characterized by the fact that a heat-shrinkable base sheet, a base cloth made of nonwoven fabric integrated by intertwining the fibers, and a mesh-like sheet of nonwoven fabric, whose interfiber distance is larger than said base sheet, are stacked in layers; they are partially bonded together; and then they are heated, heat-shrinking the aforementioned base sheet and forming the portion where the base cloth and the mesh-like sheet are bonded into depressions and the unbonded portions into projections.

Detailed explanation of the invention

[0001]

Industrial application field

This invention pertains to a disposable cleaning sheet for use in offices or homes.

[0002]

Prior art

Conventional cleaning sheets include simple sheets made of woven fabric, nonwoven fabric, etc., prepared by binding yarns together, for use as wiping cloths or chemical dust cloths as well as mops. These sheets and mops are used for cleaning either while

dry or wet. These cleaning sheets are used in homes, or used in business in offices, shops, buildings, workshops, etc.

[0003]

Problems to be solved by the invention

However, for the conventional cleaning sheets, when they are used wet, they may soil the hands, and water may be left on the surface of furniture, etc., so that wiping with a dry sheet is needed. On the other hand, when the conventional cleaning sheet is used dry, the collected dust is prone to scatter from the cleaning sheet during cleaning.

[0004]

For the so-called chemical dust cloth which has become popular in recent years, the aforementioned problems are solved by impregnating the fiber assembly with an oil agent. For said chemical wiping sheet, however, the dust (debris) adsorption depends on the oil agent. As the oil agent migrates to the cleaning surface, the oil agent becomes detached during cleaning operation, so that the cleaned surface is modified and discolored; also, the oil agent may be transferred to the hands of the operator.

[0005]

In order to solve these problems, Japanese Kokai Patent Application No. Sho 56[1981]-38374 disclosed a type of chemical

dust cloth, that can reduce the amount of oil agent attached on the cleaning surface, and Japanese Kokai Patent Application No. Sho 59[1984]-129285 disclosed a type of chemical dust cloth, processed by high-efficiency oil-impregnating treatment uniformly over all of the fibers, so as to prevent unevenness of adsorption of the oil agent. However, although these chemical dust cloths can display their effects of removing fine dust, etc., they nevertheless are unable to remove relatively large debris. That is, although they have the effect of wiping off fine dust or other dirt, the relatively large dust particles nevertheless cannot be held and are left unwiped due to the relationship between the adsorptive force and the weight of the dust.

[0006]

On the other hand, in order to remove relatively large debris, Japanese Kokai Patent Application No. Sho 53[1978]-144156 disclosed a type of chemical mop that can pick up relatively large debris between mop cords. However, for this type of chemical dust cloth, as the mop cords are not completely supported, when the mop is held up, the debris falls off. This is a disadvantage.

[0007]

The purpose of this invention is to solve the aforementioned problems of the conventional methods by providing a type of cleaning sheet that can reliably catch and remove fine dust as well as relatively large debris, as well as its manufacturing method.

[0008]

Means to solve the problems

The aforementioned purpose is reached by a type of cleaning sheet characterized by the following facts: a base sheet, a base cloth made of a nonwoven fabric integrated by means of intertwining fibers, and a mesh-like sheet formed by intertwining fibers with interfiber distance greater than that of the base cloth and placed on the outer side of the base cloth are laminated; these layers are partially bonded to each other; the bonded portions become depressions, while the unbonded portions overall form projections.

[0009]

Also, this invention provides a manufacturing method of the aforementioned cleaning sheet characterized by the following facts: after a base sheet, a base cloth made of a nonwoven fabric integrated by means of intertwining fibers, and a mesh-like sheet formed by intertwining fibers with interfiber distance greater than that of the base cloth and placed on the outer side of the base cloth are laminated, these sheets are partially bonded to be integrated; then, heating is performed so that the aforementioned base sheets are heat shrunk, so that the bonded portions between the base cloth and the mesh-like sheet become depressions, while the unbonded portions become projections.

[0010]

Function

For the cleaning sheet of this invention, the projections at the bonding portions of the base cloth softly contact the surface being cleaned; the relatively fine dust is trapped by the intertwined fibers of the nonwoven fabric, and the relatively large debris is caught inbetween the projections of the base cloth and removed. Even larger debris, such as bread crumbs, can be caught by the mesh-like sheet, while hairs and other rigid long debris can be caught by both the base cloth and the mesh-like sheet.

[0011]

Application examples

In the following, this invention will be explained in more detail with reference to application examples illustrated in Figures 1-6.

[0012]

As shown in Figures 1 and 2, cleaning sheet (10) of this invention is characterized by the following facts: base sheet (11); base cloth (12) made of a nonwoven fabric integrated by means of intertwining fibers, and mesh-like sheet (14) formed by intertwining fibers with interfiber distance greater than that of base cloth (12) and placed on the outer side of base cloth (12)

are laminated; these layers are partially bonded to each other; bonding portions (13A) among base sheet (11), said base cloth (12) and mesh-like sheet (14) become depressions, while unbonded portions (13B), (15B) overall form projections.

[0013]

For said base cloth (12), depressions/projections are formed by bonding portions (13A) with base sheet (11) and unbonded portions (13B). Bonding portions (13A) form depressions, and unbonded portions form projections. Also, as shown in Figure 1, bonding portions (13A) are formed in lattice configuration.

[0014]

As shown in Figures 1 and 2, on said base cloth (12), unbonded portions (13B) are formed as projections (12A), and bonding portions (13A) are formed as depressions (12B). Said base cloth (12) forms a cleaning surface with cushioning property by a plurality of projections (12A) and depressions (12B) among the projections. Also, because this cleaning surface is composed of intertwined fibers, the fine dust attached to the surface being cleaned can be caught in between these composing fibers. At the same time, the relatively large debris is caught as it is held in depressions (12B).

[0015]

As can be seen from cleaning sheet (40) in another application example shown in Figure 6, said base cloth (12) may

also have a constitution with slit opening (12C) formed on each bump (12A). As openings (12C) are formed, the relatively large debris that is hard for the aforementioned composing fibers to trap can be taken through openings (12C) into projections (12A).

[0016]

The size of opening (12C) is preferably in the range of 1-100 mm². If the size is smaller than 1 mm², it is useless to form openings (12C). On the other hand, if the size exceeds 100 mm², the trapped debris might fall off. This is undesired.

[0017]

The proportion of openings (12C) on the cleaning surface is preferably in the range of 5-60%. If this proportion is smaller than 5%, it is hard to trap the debris. On the other hand, if it is larger than 60%, the trapped debris falls off easily, and the processability deteriorates.

[0018]

Also, when a low-tack adhesive is coated on the inner surface of at least one of said base sheet (11) and unbonded portion (13B) of said base cloth (12), it is possible to inhibit fall-off of the debris trapped through said openings (12C). However, if the tack is too high, the film and base cloth are bonded to each other in planar form during manufacturing or in use, and the function of trapping the dust by the openings might not be displayed. Examples

of preferable low-tack adhesives include rubber adhesives, acrylic adhesives, and olefin adhesives.

[0019]

Openings (12C) are formed by partially cutting slits in sheet-form base cloth (12). Also, they may be formed by punching.

[0020]

The configuration of bonding portions (13A) between said heat-shrinkable base sheet (11) and said base cloth (12) is not limited to the aforementioned lattice shape. As long as projections (12A) can be formed by said base cloth (12), other configurations may also be adopted. For example, they may be created as multiple scattered spots in the shape of an X, dots, or squares. Or, they may be formed in a grid pattern made of multiple of parallel lines with distance between them preferably in the range of 5-100 mm. If the distance is smaller than 5 mm, as to be explained later, heat shrinkage of base sheet (11) makes it hard to form said projections (12A). On the other hand, if the distance is greater than 100 mm, said projections (12A) become too large to have good ability for trapping debris, and the appearance also deteriorates.

[0021]

An example of the material for said base sheet (11) is heat-shrinkable film (heat-shrinkable sheet of synthetic resin). Examples of the synthetic resins that can form the heat-shrinkable sheet include polyethylene, polypropylene, polybutene, and other polyolefin resins; polyethylene terephthalate, polybutylene terephthalate, and other polyester resins; polyvinyl chloride, and other vinyl resins; polyvinylidene chloride, and other vinylidene resins; polyamide resins; modified resins of the aforementioned resins; composites of the aforementioned resins and mixtures of the aforementioned resins; etc. They are processed to monoaxially shrink or biaxially shrink to be used in forming the aforementioned projections and depressions.

[0022]

Said base sheet (11) may be made of nonwoven fabric as long as it is heat-shrinkable. Also, stretchable sheets made of urethane [fibers], etc., may also be used as the base sheet.

[0023]

The thickness of said base sheet (11) can be selected appropriately in consideration of the shape and degree of the projections/depressions depending on its shrinkage power and shrinkage rate, as well as the partial bonding processability with the aforementioned nonwoven fabric.

[0024]

There is no special limitation on said base cloth (12) as long as it is integrated by intertwining fibers. Compared with the configuration in which the composing fibers are fused or bonded to each other, the configuration in which the composing fibers are intertwined with each other has a higher degree of freedom of the composing fibers, so that it works better to trap fine dust, etc., among the fibers.

[0025]

Examples of the aforementioned composing fibers of base cloth (12) include polyester fibers, polyamide fibers, polyolefin fibers, and other thermoplastic fibers; composite fibers made of these fibers; acetate and other semisynthetic fibers; cupra, rayon, and other regenerated fibers; cotton and other natural fibers; blends of the aforementioned fibers; etc. When bonding between base sheet (11) and base cloth (12) is carried out by means of heat treatment, it is preferred that the thermoplastic fibers be contained. For these composing fibers, although a high freedom is preferred, partial fusion or bonding among the composing fibers for increasing the strength of the nonwoven fabric may also be performed.

[0026]

The basis weight of said base cloth (12) should be selected appropriately in consideration of the intertwining degree of the composing fibers, strength, processability, and cost. Usually, it

is preferably in the range of 30-150 g/m². If the basis weight is smaller than 30 g/m², the intertwining degree and strength are not high enough. On the other hand, if the basis weight is larger than 150 g/m², the cost rises, and this is undesired, too. Also, the size of the aforementioned composing fibers is preferably in the range of 0.5-6.0 d. If the fiber size is smaller than 0.5 d, the web formability of the fibers deteriorates. On the other hand, if the fiber size is larger than 6.0 d, it is hard to intertwine the fibers, and it is thus difficult to trap the fine dust.

[0027]

For said base cloth (12), if needed, appropriate surface treatment may be carried out by using a surfactant, oil agent, or low-tackiness adhesive so as to improve the adsorption for dust, etc. Also, if needed, the surface of the base cloth may be processed appropriately by an oil agent, etc., to make the surface being cleaned glossy.

[0028]

Mesh-like sheet (14) is a nonwoven fabric with a greater interfiber distance than that of base cloth (12). The type and size of the composing fibers are identical to those of the nonwoven fabric as the base cloth. It is preferred that intertwining among fibers be carried out by impacting the web with a water stream or an air stream. In this case, the intertwining degree is correlated to the dust retention. Also, the strength of the nonwoven fabric depends on the type of the composing fibers, the properties, and the basis weight. Also, the interfiber

distance defined by the following formula has a major influence on the strength of the nonwoven fabric. Interfiber distance $a(m)$ can be calculated using the following formula (1).

[0029]

[Mathematical formula 1]

$$a = (DV/9000W)^{1/2}$$

D: fiber size (d)

V: volume of nonwoven fabric (m^3)

W: weight of nonwoven fabric (g)

Here, volume V of the nonwoven fabric is calculated from the thickness and area of the nonwoven fabric under no load.

[0030]

Here, volume V of the nonwoven fabric is calculated from the thickness and area of the nonwoven fabric under no load [sic]. When the interfiber distance becomes too large, the strength decreases. On the other hand, when the interfiber distance is too small, the degree of freedom of the fibers is lowered, and the ability to trap bread crumbs and other relatively large solid debris becomes poor. For base cloth (12), the interfiber distance is 80 μm or shorter, for mesh-like sheet (14), the interfiber distance should be 50 μm or larger. For base cloth (11) and mesh-like sheet, the interfiber distances should meet the following relationship:

[0031]

[Mathematical formula 2]

Interfiber distance of the base cloth < interfiber distance of the mesh-like sheet

[0032]

There is no special limitation on the configuration of the mesh of mesh-like sheet (14), as long as the sites where fibers are present and the sites where holes are present are in a regular shape. However, if the mesh of the mesh-like sheet has openings that are too large, it becomes hard to trap bread crumbs and other relatively large solid debris. On the other hand, if the openings are too small, the wiping effect of the base cloth might deteriorate. Consequently, it is necessary to select an appropriate size of the openings of the mesh-like sheet.

[0033]

Figures 3 and 4 show cleaning sheet (30) in a modified example of the configuration of base cloth (12) and mesh-like sheet (14) placed on the two sides of base sheet (11), respectively. The parts are the same as those in Figures 2 and 3, and are represented by the same symbols, and a detailed explanation of them is omitted here.

[0034]

In the following, a preferable embodiment of this invention in manufacturing said cleaning sheet (10) will be explained together with the manufacturing equipment.

[0035]

As shown in Figure 6, this manufacturing equipment (20) has a configuration appropriate for manufacturing cleaning sheet (40) shown in Figure 6, with mesh-like sheet (14) only on one side and with openings (12C) formed on base cloth (12). As shown in Figure 7, base sheet (11), base cloth (12), and mesh-like sheet (14) are released from their respective rolls. Roll of base cloth (12) is released by releasing device (21).

[0036]

Base cloth (12) released by releasing device (21) has multiple stripe-shaped openings (12C) as shown in Figure 6 formed by opening-forming machine (23) set downstream from releasing device (21). Said opening-forming machine (23) has a rotary die cutter (23A) and anvil roller (23B). As base cloth (12) is passed through rotary cutter (23A) and anvil roller (23B), multiple openings (12C) are formed by rotary die cutter (23A).

[0037]

Also, formation of openings (12C) may be carried out immediately before bonding and integration with heat-shrinkable

base sheet (11). When a low-tack adhesive is applied to base sheet (11) and the nonwoven fabric as base cloth (12) to prepare the bonding surfaces so as to improve the retention of dust entering through the openings, although it is acceptable to apply the adhesive during manufacturing base sheet (11) or the nonwoven fabric as the base cloth, it is preferred that it be applied immediately before bonding and integration of the nonwoven fabric as base cloth (12) with base sheet (11), in consideration of the releasing property (blocking).

[0038]

Base sheet (11) is released from the upper side by guide roller (24A) set downstream from opening-forming machine (23), and it is overlapped on base cloth (12) that has been transported there. Corresponding to base sheet (11), mesh-like sheet (14) is disposed on the lower side of base cloth (12). By means of guide roller (24B), it is released from the lower side, and is overlapped with base cloth (12) which has been transported there.

[0039]

By means of guide rollers (24A) and (24B), base sheet (11) and mesh-like sheet (14) are overlapped on base cloth (12), followed by bonding to, for example, a lattice form as shown in Figure 6, by bonding machine (25) set downstream from guide rollers (24A) and (24B). Said bonding machine (25) fuses base cloth (12) and base sheet (11) by means of ultrasonic welding. Said bonding machine (25) has a horn (25A) that emits an ultrasonic wave and embossing roller (25B) that has a mold for

forming a lattice pattern. As the stack of base cloth (12) and base sheet (11) passes between them, as shown in Figure 6, these sheets (11), (12), (14) are bonded to each other, forming lattice-like bonding portions (13A). The method is not limited to ultrasonic waves for said bonding machine (25). It is also possible to adopt a heating method or other method. The specific method can be selected appropriately in consideration of the processing speed and the stock material.

[0040]

The laminate of base cloth (12), base sheet (11), and mesh-like sheet (14) integrated by bonding machine (25) is pulled out by nip roller (26) set downstream from bonding machine (25), and is transferred to heat treatment device (27). This heat treatment device (27) is for heat shrinking. It has a heating chamber for heating base sheet (11) to the heat-shrinkable temperature. As integrated base cloth (12) and base sheet (11) pass through heat treatment device (27), for base sheet (11) alone, heat shrinkage takes place at the unbonded portions surrounded by lattice-like bonding portions (13A), while projections (12A) are formed on base cloth (12), forming cleaning sheet (40) shown in Figure 6.

[0041]

After passing through heat treatment device (27), cleaning sheet (10) is pulled out by nip rollers (28), (28) set downstream from heat treatment device (27), and cleaning sheet (40) is wound onto a roll by winder (29).

[0042]

In this way, said cleaning sheet (40) is manufactured in the aforementioned manufacturing device as follows.

[0043]

First of all, as base cloth (12) is fed from releasing device (21), on the downstream side and parallel to it, base sheet (11) is fed from the upper side, while mesh-like sheet (14) is fed from the lower side. As fed base cloth (11) directly reaches guide rollers (24A) and (24B), base cloth (12) goes through opening forming machine (23), where the base cloth is cut by rotary die cutter (23A) to form stripe-shaped openings (12C), and reaches guide rollers (24A) and (24B). Consequently, base sheet (11), mesh-like sheet (14), and base cloth (12) with openings formed on it are overlapped by guide rollers (24A) and (24B). Such overlapped base sheet (11), base cloth (12), and mesh-like sheet (14) are bonded and integrated by means of ultrasonic fusion on bonding machine (25). The laminate is pulled out by nip rollers (26), (26) and is transferred to heat treatment device (27). In this case, the sheet becomes as shown in Figure 3 (or Figure 5, when mesh-like sheets (14) are placed on both sides). When integrated base sheet (11), base cloth (12) and mesh-like sheet (14) pass through heat treatment device (27), only base sheet (11) is heat shrunk. As shown in Figure 2 (or Figure 4, when mesh-like sheets (14) are placed on both sides), projections (12A) are formed on the unbonded portions of base cloth (12). In this way, cleaning sheet (40) is formed. This cleaning sheet (40) is pulled

out from heat treatment device (27) by nip rollers (28), (28), and is wound onto a roll (10) by winder (29).

[0044]

In the following, the cleaning sheet of this invention will be explained in more detail with reference to application examples.

[0045]

Application Example 1

Base cloth (12) with interfiber distance of 60 μm was prepared by forming a web (basis weight of 100 g/m²) from 1.5 d, 51-mm polyester fibers using the conventional carding method, followed by intertwining by means of water needling. Said base cloth (12), 100- μm mesh-like sheet (14), and base sheet (11) made of 40- μm biaxially shrunken film of polyester were bonded and integrated in a lozenge shape with 1 edge length of 30 mm and 30° diamond pattern by an ultrasonic embossing machine. With a heat shrinkage of 20% (under heat treatment conditions of 110°C for 30 sec), a cleaning sheet (20 x 20 cm) was formed.

[0046]

The heat shrinkage was measured by following Formula 3.

[0047]

[Mathematical formula 3]

Heat shrinkage = (Edge length before heat shrinking - edge length after heat shrinking)/edge length before heat shrinking x 100 (%)

[0048]

Application Example 2

With a ratio of 50/50, 1.5, 51-mm polypropylene fibers and 1.5, 51-mm rayon fibers were blended, and a web (basis weight of 70 g/m²) was formed using the conventional carding method, followed by intertwining by means of water needling to form a base cloth with interfiber distance of 60 µm. With a pitch of 5 cm in the flow direction, slits were cut with length of 2.5 cm, with the pitch between adjacent slits of 1 cm. The base cloth and a mesh-like sheet with interfiber distance of 100 µm prepared in the same way were used to form a composite sheet. The sheet and a 30-µm biaxially shrinking film of polypropylene were bonded and integrated to a square-shaped pattern with edge length of the squares of 20 mm on an ultrasonic embossing machine. Then, heat treatment was performed to form a cleaning sheet (20 x 20 cm) with a heat shrinkage of 80%.

[0049]

Application Example 3

A cleaning sheet was prepared in the same way as in Application Example 2, except that base sheet (11) in the cleaning sheet in Application Example 2 was coated with a 15- μm -thick coating layer of a rubber-type adhesive. In Comparative Example 1, integration was performed under the same conditions as in Comparative Example 1, except that only the base cloth and the base sheet were used, while the mesh-like sheet was absent.

[0050]

For the cleaning sheets prepared in said Application Examples 1-3 and Comparative Example 1, tests were performed on collections of dust, such as cotton dust, bread crumbs, and hair. The results are listed in Table I.

[0051]

Table I

//insert table p.6//

The adhesive used was the rubber type (SEBS type).

Assessment of dust collectability

- ◎ Collection made free of any problem
- Collection made with little problem
- △ Collection made yet with significant dust left uncollected

- Key:
- 1 Classification
 - 2 Yes/No of mesh-like sheet
 - 3 Yes/No of adhesive
 - 4 Type of dust and collectability
 - 5 Cotton dust
 - 6 Bread crumbs
 - 7 hair
 - 8 Application Example

- 9 Comparative Example
- 10 Yes
- 11 No

[0052]

As can be seen from the results listed in Table I, the cleaning sheets of this invention (Application Examples 1-3) are capable of trapping dust particles of different sizes, including cotton dust, bread crumbs, and hair, reliably. When an adhesive is applied to the base cloth (Application Example 2), the efficiency in trapping the dust becomes even higher. On the other hand, for the sheet prepared in Comparative Example 1, although it can trap some cotton dust and hair, it nevertheless is unable to trap the bread crumbs well.

[0053]

This invention is not limited to the aforementioned application examples. As long as the main points of this invention are observed, various modifications can be made.

[0054]

For example, in the aforementioned application examples, the main body made of the base sheet and the base cloth were formed with the base sheet and the base cloth having nearly the same dimensions. However, the method is not limited to this. It is also possible to have the dimensions of the base cloth larger than those of the base sheet. In this case, the degree of freedom in

the cleaning operation becomes larger, and sufficient cleaning effect can be realized.

[0055]

Effect of the invention

The cleaning sheet of this invention is capable of reliably trapping various types of dust/debris, from relatively fine dust to relatively large debris.

[0056]

Also, the manufacturing method of the cleaning sheet of this invention enables high-speed manufacturing of the aforementioned cleaning sheets in a stable manner.

Brief description of the figures

[Figure 1] This is an oblique view illustrating the cleaning sheet in an application example of this invention.

[Figure 2] This is a cross-sectional view illustrating the cleaning sheet shown in Figure 1.

[Figure 3] This is a cross-sectional view illustrating the state of the sheet before heat treatment.

[Figure 4] This is a cross-sectional view illustrating the cleaning sheet in a modified example of this invention

[Figure 5] This is a cross-sectional view illustrating the state of the cleaning sheet shown in Figure 4 before heat treatment.

[Figure 6] This is a cross-sectional view illustrating the cleaning sheet in another application example of this invention.

[Figure 7] This is a schematic diagram illustrating the overall manufacturing equipment that can be preferably used in manufacturing the cleaning of Figure 6 sheets in the application examples.

Explanation of symbols

10, 30, 40	Cleaning sheet
11	Base sheet
12	Base cloth
12A	Bump
12B	Dip
12C	Opening
14	Mesh-like sheet

Figure 1